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THE ODDA PROCESS AND ITS APPLICATION IN LESS DEVELOPED AREAS

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The Odda Process and its Application in less developed Areas.

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SUMMARY.

When building up a fertilizer industry in less developed areas, products and processes must be chosen by careful evaluation of possibilities and existing trends in this field. In many cases concentrated complex fertilizers will be preferable. Sulfuric acid is not necessary for this production. The acid function in phosphate digestion can profitably be performed by nitric acid, giving valuable calcium nitrate as a byproduct instead of worthless gypsum from the sulfuric acid.

The best process based on nitric acid digestion of phosphate rock is the Odda process, invented in 1928 by Erling Johnson, Odda, Norway. It is used in Germany, Norway, the Netherlands, France and Finland. The production based on this process was last year 1.5 - 2.0 million tonnes of complex fertilizer, and is increasing.

All main types of phosphate rock may be used as raw material, but for the most favorable accomplishment of the process, some limitating specifications as to mechanical properties and composition should be taken into account.

Other raw materials are 60 % nitric acid, gaseous ammonia and possibly other supplementary materials giving the fertilizer the desired content of potassium and secondary minor plant nutrients.

The phosphate rock is digested in an excess of 15 - 25 % nitric acid. The heat of reaction raises the temperature to 55 - 70°C, and the digested phosphatic solution is cooled in crystallizers to 17°C or lower. $Ca(NO_3)_2 \cdot 4H_2O$ will then crystallize, and is removed by centrifuging or filtration. The crystals having a melting point of 42°C are melted, neutralized with ammonia, concentrated by evaporation and prilled in a spray tower as nitrate of lime. In tropic areas the hygroscopic nitrate of lime is somewhat inconvenient to handle, and in this case the calcium nitrate may be converted to ammonium nitrate limestone, or better, it may be kept in solution together with ammonium nitrate. A solution of 34 % calcium nitrate and 32 % ammonium nitrate with a nitrogen content of 1 % and a crystallisation point of 4°C should be well fitted for distribution.

The mother liquor from the separation of calcium nitrate is neutralized in two or more steps with ammonia. During this neutralization calcium phosphate, calcium fluoride and different impurities are precipitated, and dissolved ammonium nitrate and ammonium phosphate are formed. This NP-slurry is concentrated by evaporation, granulated - if wanted with addition of other plant nutrients -, dried and screened. The undersize particles below 1.0-1.5 mm and oversize particles above 3,5 - 4.5 mm are recycled, the coarse fraction via a mill. The product is conditioned with kieselguhr or other agents for prevention of caking.

If we suppose that all nitrogen is originally present as liquid ammonia, the demand for cooling and steam will be more than covered by evaporation and oxidation of the NH_3. The demand for fuel oil is about 10 kg, and for electricity 70 kWH pr ton NP-product.

For a factory with a capacity of 85 000 tonnes NP-fertilizer 20 - 9 (20 % N, 9 % P) or 130 000 tonnes NPK 13 - 6 - 17, the investment is about 2.5 - 3.0 million $ and a corresponding nitric acid plant will amount to 1.5 - 2.0 million $. The necessary staff in a factory of this size will be 45 - 50 men.

The chemical composition of the product can be varied within wide limits and meet practically any agricultural requirement. The amount of water soluble phosphorous is normally about 30 % of the total phosphorous, and the citrate soluble amount 95 - 100 %. By further cooling the water soluble part can be increased to about 90 %.

Today the production and consumption of fertilizer made by the Odda process is concentrated in the northern and the middle part of Europe.

As a whole the fertilizing effiency corresponds to the same amount of plant nutrients given as straight materials. A somewhat slower action of the phosphorous may be found than compared with superphosphate.

In addition to being economic in production and covering all main agricultural demands, a concentrated, complete and ready-to-use fertilizer of the Odda process type will save money and labour.

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